CLAIMS

1. A diamond composite substrate, comprising:

a diamond monocrystalline substrate; and

a diamond polycrystalline film laminated thereon by a vapor phase synthesis.

2. A diamond composite substrate according to Claim 1, wherein a difference between an orientation of a main face, which has a largest surface area of the diamond monocrystalline substrate, and an orientation of a {100} plane is no more than 5 degrees, and the diamond polycrystalline film is laminated on an opposite face parallel to said main face.

3. A diamond composite substrate according to Claim 2, wherein the main face is the {100} plane.

4. A diamond composite substrate according to any of Claims 1 to 3, wherein a spacing between the main faces, which is a thickness of the diamond monocrystalline substrate, is at least 0.1 mm and no more than 1 mm.

5. A diamond composite substrate according to any of Claims 1 to 4, wherein a thickness of the diamond polycrystalline film laminated over the diamond monocrystalline substrate is at least 0.1 mm and no more than 1 mm.

6. A diamond composite substrate according to any of Claims 1 to 5, wherein a ratio of the thickness of the diamond monocrystalline substrate to the thickness of the diamond polycrystalline film is between 1:1 and 1:4.

7. A diamond composite substrate according to any of Claims 1 to 6, wherein the diamond monocrystalline substrate is made up of a plurality of diamond monocrystals all having a same orientation of the main face having the largest surface area, and these plurality of diamond monocrystals are joined by the diamond polycrystalline film formed by the vapor phase synthesis over said diamond monocrystals.

8. A diamond composite substrate according to any of Claims 1 to 7, wherein the difference between orientations of the plurality of diamond monocrystals in a direction of rotation with respect to an axis perpendicular to the main faces thereof is no more than 2 degrees, and the difference between the orientations of the respective main faces and the orientation of the {100} plane is no more than 5 degrees.

9. A diamond composite substrate according to Claim 8, wherein the orientation of the main faces of the plurality of diamond monocrystals is {100}.

10. A diamond composite substrate according to any of Claims 7 to 9, wherein a difference in thickness between the respective diamond monocrystals is no more than 10 μm.

11. A diamond composite substrate according to any of Claims 7 to 10, wherein a gap between the plurality of diamond monocrystals is no more than 500 μm.

12. A diamond composite substrate, wherein a diamond monocrystalline substrate is made up of a plurality of diamond monocrystals in which a difference between orientations of the diamond monocrystals in a direction of

rotation with respect to an axis perpendicular to main faces thereof is no more than 2 degrees, and a difference between orientations of the respective main faces and an orientation of a {100} plane is no more than 5 degrees, the diamond monocrystals are joined by a diamond polycrystalline film formed by a vapor phase synthesis on an opposite face parallel to the respective main faces of the diamond monocrystals, and an entire surface of said main face is integrated by vapor-phase synthesized diamond monocrystals grown using the diamond monocrystalline substrate as a seed crystal.

13. A diamond composite substrate according to Claim 12, wherein the orientation of the main faces of the plurality of diamond monocrystals is {100}.

14. A diamond composite substrate according to Claim 12 or 13, wherein a spacing between the main faces, which is a thickness of the plurality of diamond monocrystalline substrates, is at least 0.1 mm and no more than 1 mm.

15. A diamond composite substrate according to any of Claims 12 to 14, wherein a thickness of the diamond polycrystalline film formed by the vapor phase synthesis over the diamond monocrystals is at least 0.1 mm and no more than 1 mm.

16. A diamond composite substrate according to any of Claims 12 to 15, wherein a ratio of the thickness of the diamond monocrystals to the thickness of the diamond polycrystalline film is between 1:1 and 1:4.

17. A diamond composite substrate according to any of Claims 12 to 16, wherein a gap between the plurality of

diamond monocrystals is no more than 500 μm.

18. A diamond composite substrate according to any of Claims 12 to 17, wherein a difference in the thickness between the plurality of diamond monocrystals is no more than 10 μm.

19. A diamond composite substrate according to Claims 12 to 18, wherein a surface of the diamond polycrystalline film has been polished.

20. A diamond composite substrate according to any of Claims 12 to 19, wherein a surface roughness Rmax of the diamond polycrystalline film is no more than 0.1 μm.

21. A method for manufacturing a diamond composite substrate, wherein a plurality of diamond monocrystals having a same orientation are lined up, a diamond polycrystalline film is formed by a vapor phase synthesis over said monocrystals, and the plurality of diamond monocrystals are joined by the diamond polycrystalline film.

22. A method for manufacturing a diamond composite substrate according to Claim 21, wherein a deviation between orientations of the plurality of diamond monocrystals in a direction of rotation with respect to an axis perpendicular to main faces thereof, which has a largest surface area, is no more than 2 degrees, and a difference between orientations of the respective main faces and an orientation of a {100} plane is no more than 5 degrees.

23. A method for manufacturing a diamond composite substrate according to Claim 22, wherein the main face

having the largest surface area of the faces that make up the diamond monocrystals is the {100} plane.

24. A method for manufacturing a diamond composite substrate according to any of Claims 21 to 23, wherein a thickness of the diamond monocrystals is at least 0.1 mm and no more than 1 mm.

25. A method for manufacturing a diamond composite substrate according to any of Claims 21 to 24, wherein a thickness of the diamond polycrystalline film formed by the vapor phase synthesis over the diamond monocrystals is at least 0.1 mm and no more than 1 mm.

26. A method for manufacturing a diamond composite substrate according to any of Claims 21 to 25, wherein a ratio of the thickness of the diamond monocrystals to the thickness of the diamond polycrystalline film is between 1:1 and 1:4.

27. A method for manufacturing a diamond composite substrate according to any of Claims 21 to 26, wherein a difference in thickness between the plurality of diamond monocrystals is no more than 10 μm.

28. A method for manufacturing a diamond composite substrate according to any of Claims 21 to 27, wherein a gap between the plurality of diamond monocrystals is no more than 500 μm.